

NERL Research Abstracts

EPA's National Exposure Research Laboratory

GRPA Goal 3 - Safe Food

APMs # 681 and # 663

Significant Research Findings

Handling of Food by Young Children Can Increase Dietary Exposure to Pesticides

Purpose

The National Exposure Research Laboratory's goal is to reduce the level of uncertainty in dietary exposure assessment by improving the ability to measure dietary intake for young children. The Food Quality Protection Act (FQPA) of 1996 requires improved aggregate exposure assessments for children. Young children's activities and handling of foods prior to consumption can increase contamination of the food, thereby increasing their dietary exposure. A child's food contacts surfaces that may be contaminated with pesticides that can then be transferred to food. Research was conducted to assess dietary exposure of young children by developing measurement protocols that incorporate contamination potential, by conducting field measurements to determine how well the protocols work, and through the development of a dietary intake model used to estimate exposure from foods that have been handled by children prior to consumption.

Research Approach

A simplistic, deterministic model was developed to identify the critical input parameters needed to assess dietary intakes of pesticides by young children. The model was used as a framework for understanding the important factors in data collection and data analysis. The sum of three major contributing factors characterizes a young child's dietary intake of a pesticide: (1) the original pesticide residue on prepared foods before they are handled by the child; (2) surface-to-food contamination as the foods come into contact with contaminated surfaces before being consumed by the child; and (3) surface-to-hand-to-food contamination as the child touches contaminated surfaces and then handles and eats the foods. Total daily dietary intake was determined by summing intakes for all food items and associated contacts of each food with hands and contaminated surfaces. A pesticide solution that included chlorpyrifos, diazinon, and malathion was applied to hardwood flooring, carpet, ceramic tile, plastic, and cloth surfaces. Food items such as luncheon meats, apple, bread, and cheese, were brought into contact with the surfaces, and the amount of pesticide transferred was measured. Frequencies and durations of

food contacts with surfaces were determined by videotaping children while they ate. Model simulations were conducted using transfer efficiency measurements, activity factors, and other input factors to the dietary model to estimate the overall intake of a pesticide for different food items and the relative importance of each model term to total pesticide intake.

Major Findings and Significance

Model simulations revealed that pesticides transferred to food caused by contact with surfaces and handling by a child would increase dietary intake significantly. For example, handling of the food by the child's contaminated hand accounted for over 60% of the excess intake. A sensitivity analysis demonstrated that when the actual measurements of the parameters are around the means or medians of the distribution, the most sensitive parameters are the food pesticide residue and surface loading of the pesticide. However, when the actual measurements are at the higher end of the distribution (e.g., 90th percentile), surface-to-food and surface-to-hand transfer efficiencies, and the proportion of the food in contact with the surface become important, as well as surface loading.

Higher pesticide transfer occurs from the surface to food for hard, smooth surfaces, such as hardwood flooring and plastic; lower transfers occur from carpet and cloth. For example, 80% of chlorpyrifos was transferred from a plastic surface to an apple, whereas only 11% occurred from a carpet.

Understanding how pesticides or other surface contaminants can be transferred to a child's food and the important activities that contribute to excess intake will assist the exposure assessor in determining actual dietary intakes.

Publications

- Adcox, C., Berry, M.R., Akland, G.G., Roberds, J.M., Pellizzari, E.D. Transfer of Pesticides from Surfaces to Foods for the Estimation of Dietary Exposure of Children. Presented at ACS National Meeting, New Orleans, LA, 8/22-29, 1999.
- Akland, G., Pellizzari, E.D., Hu, Y., Clayton, A., Long, K., Roberds, M. The Three Interacting Factors Associated with Children's Dietary Exposures: Environmental Concentrations, Food Contamination, and Children's Behaviors. Presented at ACS National Meeting, New Orleans, LA, 8/22-29, 1999.
- Akland, G.G., Pellizzari, E.D., Hu, Y.A., Whitaker, D.A., Melnyk, L.J., Berry, M.R., Leckie, J.O. Dietary Exposures of Young Children, Part 2: Field Study. Presented at the Annual Conference of the International Society of Exposure Analysis, Monterey, CA, 10/24-27, 2000.
- Akland, G.G., Pellizzari, E.D., Hu, Y.A., Roberds, J.M., Rohrer, C.A., Leckie, J.O., Berry, M.R. Factors influencing total dietary exposures of young children. *Journal of Exposure Analysis and Environmental Epidemiology*. In press.
- Berry, M.R., Adcox, C., Melnyk, L.J., Akland, G.G., Hu, Y.A., Clayton, A.C., Aragon, E.D., Roberds, J.M., Pellizzari, E.D. Measuring Dietary Exposure of Young Children. Presented at ACS National Meeting, New Orleans, LA, 8/22-29, 1999.
- Hu, Y.A., Akland, G.G., Pellizzari, E.D., Clayton, A., Melnyk, L.J., Berry, M.R. Dietary Exposures of Young Children, Part 3: Modeling. Presented at the Annual Conference

of the International Society of Exposure Analysis, Monterey, CA, 10/24-27, 2000.

Hu, Y.A., D.B. Barr, G.G. Akland, L.J. Melnyk, L. Needham, E.D. Pellizzari, J.H. Raymer, J.H., Roberds, J.M. Collecting urine samples from young children using cotton gauze for pesticide studies. *Journal of Exposure Analysis and Environmental Epidemiology*. In press.

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Rohrer, C.A., Hieber, T., Melnyk, L.J., Berry, M.R. Pesticide transfer efficiency from household surfaces to foods. Presented at the Annual Conference of the International Society of Exposure Analysis, Monterey, CA, 10/24-27, 2000.

**Future
Research**

This research will continue with additional surface transfer efficiency measurements with particular emphasis on accurate measurement of pesticides transferred to foods from various surfaces, quantifying activities of children through videotape analysis, and analyzing field study data from three home environments to evaluate the dietary intake model.

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